ported from the Lake region, and a maximum velocity of 52 miles from the south New England coast on the 22d. The winds continued high on the New England coast on the 23d. The rise in temperature in advance of the centre was about 10°; it rose 10° to 20° above the normal in New England and the middle Atlantic states on the 22d.

VII.—This storm was central north of Montana on the 21st; it followed very closely the track of No. VI in its eastward movement to the Gulf of Saint Lawrence, where it was central on the 28th. The only precipitation reported was in the upper lake region, where local rains accompanied the fall in temperature after the centre had passed to the eastward. In connection with the absence of precipitation is noted the continued high wind velocities that accompanied the storm. On the 25th the wind in the Missouri Valley was from the south, with velocities of 25 to 35 miles per hour, and the temperature rose 15° to 25° above the normal. In Manitoba it was 25° to 38° above the average for the last decade of the month. The high winds continued in the Western States until the 27th, and on this day the velocities reported for the Lake region ranged from 20 to 40 miles per hour. The greatest change in temperature was a rise of 30° in the upper lake region on the 26th and 30° in New England on the 27th. There was a very marked difference in temperature between the east and west sides of the storm. The evening temperature at the centre remained from 75° to 85° (or 20° to 30° above the normal) until it reached New England where it was about 10° lower.

VIII.—This storm started and followed in nearly the same path as the two preceding ones; it was characterized, as was No. VII, by an almost total absence of precipitation and continued high winds and warm weather. Showers were reported from the southern portion of the Lake region and from the Ohio Valley on the 30th, and high winds from the upper Mississippi and Missouri valleys on the 28th and 29th, from the Lake region on the 29th and 30th, and from the Atlantic coast stations on the 30th. The greatest rise in temperature was 36° over the Lake Superior region on the 29th. The rise in temperature on the Atlantic coast was from 10° to 20°.

*Tabulated statement showing principal characteristics of areas of high and low pressure.*

| Barometer. | First observed. | | | Last observed. | | Duration. | Velocity per hour. | Maximum pressure change and maximum abnormal temperature change in twelve hours and maximum wind velocity. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date. | Lat. N. | Long. W. | Lat. N. | Long. W. | | | Station. | Rise. | Date. | Station. | Fall. | Date. | Station. | Direction. | Miles per hour. | Date. |
| High areas. | | ° | ° | ° | ° | *Days.* | *Miles.* | | *Inch.* | | | ° | | | | | |
| I | 1 | 52 | 109 | 27 | 80 | 6.0 | 23 | Port Arthur, Ont | .30 | 3 | Nashville, Tenn | 18 | 2 | Chicago, Ill | n. | 40 | 3 |
| II | 6 | 50 | 85 | 43 | 67 | 5.0 | 19 | Sydney, C. B. I | .40 | 8 | Lynchburgh, Va | 9 | 10 | Block Island, R. I | nw. | 34 | 7 |
| III | 10 | 38 | 109 | 33 | 75 | 5.0 | 19 | Valentine, Nebr | .24 | 10 | Springfield, Ill | 12 | 10 | Valentine, Nebr | nw. | 48 | 9 |
| IV | 12 | 49 | 107 | 48 | 64 | 2.5 | 33 | Saint Vincent, Minn | .48 | 13 | Concordia, Kans | 26 | 13 | Fort Sully, S. Dak | nw. | 38 | 12 |
| V | 15 | 42 | 85 | 33 | 77 | 3.0 | 22 | Buffalo, N. Y | .22 | 15 | Oswego, N. Y | 8 | 15 | Kitty Hawk, N. C | sw. | 34 | 18 |
| VI | 17 | 51 | 110 | 33 | 78 | 5.5 | 27 | Fort Sully, S. Dak | .40 | 17 | Port Huron, Mich | 17 | 19 | Valentine, Nebr | nw. | 38 | 17 |
| VII | 21 | 42 | 124 | 34 | 79 | 6.0 | 33 | Rockliffe, Ont | .28 | 23 | Rockliffe, Ont | 16 | 23 | Northfield, Vt | nw. | 36 | 23 |
| VIII | 24 | 41 | 124 | 32 | 80 | 5.5 | 32 | Denver, Colo | .56 | 26 | Huron, S. Dak | 32 | 26 | Cheyenne, Wyo | nw. | 44 | 26 |
| Mean | | | | | | 4.8 | 26 | | .36 | | | 17 | | | | 39 | |
| Low areas. | | | | | | | | | Fall. | | | Rise. | | | | | |
| I | 1 | 38 | 99 | 48 | 61 | 4.0 | 26 | Boston, Mass | 1.02 | 3 | Jacksonville, Fla | 11 | 2 | Boston, Mass | se. | 60 | 3 |
| II | 6 | 47 | 125 | 49 | 64 | 7.0 | 23 | Eureka, Cal | .40 | 6 | Indianapolis, Ind | 16 | 9 | Fort Canby, Wash | se. | 60 | 6 |
| III | 10 | 52 | 116 | 43 | 64 | 5.0 | 35 | Pueblo, Colo | .30 | 11 | Grand Haven, Mich | 17 | 13 | Eastport, Me | ne. | 38 | 15 |
| IV | 15 | 52 | 112 | 47 | 59 | 3.5 | 35 | Saint Paul, Minn | .38 | 16 | Pittsburg, Pa | 22 | 17 | Sioux City, Iowa | s. | 52 | 16 |
| V | 17 | 38 | 109 | 33 | 103 | 3.0 | 17 | Santa Fé, N. Mex | .18 | 20 | Palestine, Tex | 14 | 20 | Corpus Christi, Tex | nw. | 60 | 20 |
| VI | 18 | 52 | 115 | 48 | 60 | 6.0 | 22 | Portland, Me | .34 | 22 | Sandusky, Ohio | 21 | 22 | Block Island, R. I | sw. | 52 | 22 |
| VII | 21 | 53 | 116 | 48 | 63 | 7.0 | 17 | Prince Albert, N. W. T | .50 | 22 | Helena, Mont | 22 | 22 | Fort Sully, S. Dak | s. | 46 | 25 |
| VIII | 27 | 53 | 113 | 47 | 77 | 3.0 | 25 | Saint Vincent, Minn | .52 | 28 | Duluth, Minn | 26 | 29 | Saint Paul, Minn | se. | 38 | 28 |
| Mean | | | | | | 4.8 | 25 | | .45 | | | 19 | | | | 51 | |

## NORTH ATLANTIC STORMS FOR APRIL, 1891 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the west part of the north Atlantic Ocean during April, 1891, are shown on Chart I. These paths have been determined from international observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

A notable feature of April, 1891, was the unusual number of storms which appeared in the middle latitudes, several of which moved eastward to mid-ocean south of the trans-Atlantic steamship routes, and at least two of these passed eastward over the Bay of Biscay. Of the storms traced but one was severely felt over the ocean; this storm advanced northeast along the Atlantic coast of the United States during the 2d and 3d, attended by severe gales which caused damage to shipping and seaside property.

The month opened with low pressure along the trans-Atlantic steamship routes. A storm with pressure below 29.40 (747) and fresh to strong gales was central east of Newfoundland, having advanced from south of Newfoundland where it was central March 31st; a storm of moderate energy was central northeast of Bermuda, where the pressure fell to 29.80 (757) at 4 p. m., with a sw. to w. gale; the pressure was low over mid-ocean; and a storm with pressure below 29.50 (749) was central west of the British Isles. On the 2d the storm east of Newfoundland on the 1st had moved ne. of the Grand Banks, with pressure below 29.10 (739); the storm near Bermuda had moved e. about 10°; and the storm over the eastern part of the ocean had advanced to the British Isles, with pressure 29.40 (747) in Ireland. The evening of the 2d a storm of considerable strength which had advanced from the Ohio Valley was central near Cape Hatteras. By the morning of the 3d the Cape Hatteras storm had moved to the s. New England coast, with pressure below 29.40 (747); the Bermuda storm had advanced to se. of the Grand Banks; the pressure continued low over mid-ocean; and the barometer fell to 29.20 (742) at Valentia, Ireland. The morning of the 4th the Atlantic coast storm had advanced to New Brunswick, with pressure below 29.30 (744) and fresh to strong gales; the Bermuda storm was central w. of the Azores; and the pressure was below 29.30 (744) west of Ireland. During the 5th and 6th the storm central over New Brunswick on the 4th moved northeastward over the Gulf of Saint Lawrence and north Newfoundland and disappeared north of the region of observation, and the pressure was low and a storm was apparently central near the Azores.

On the 5th the pressure fell below 29.50 (749) nw. of Ireland. On the 6th the pressure was low over the British Isles, and a

storm was apparently central w. of the Bay of Biscay. On the 7th a storm, with pressure below 29.40 (747) and strong gales, appeared s. of Newfoundland, whence it moved ne. and disappeared north of the region of observation after the 8th, and a storm had apparently passed eastward from the British Isles and the Bay of Biscay over the continent of Europe. During the 9th and 10th a storm passed eastward over mid-ocean in high latitudes. On the 11th a storm, with pressure about 29.50 (749) and fresh gales, was central about midway between the Azores and the Grand Banks. By the 12th this storm had apparently advanced n. of e. toward the British Isles.

During the 13th and 14th a storm moved over the north Gulf of Saint Lawrence and the Straits of Belle Isle, and disappeared north of the region of observation. On the 17th a storm, with pressure below 29.70 (754), snow, and sleet was central se. of Newfoundland, whence it moved slowly ene., with fresh to strong gales, and disappeared over mid-ocean after the 19th. On the 20th 2 storms of considerable energy were central e. of the Grand Banks, one of which had advanced from the Gulf of Saint Lawrence and the other was apparently a secondary development to the storm which had moved ene. from the Grand Banks from the 17th to 19th. The morning of the 21st the two storms referred to had changed their position but slightly; by the 22d they had apparently united and a storm of marked strength was central e. of the Banks of Newfoundland. On this date a storm was apparently central about midway between the Bay of Biscay and the Azores, whence it moved eastward and disappeared after the 23d.

On the 23d the storm central e. of the Grand Banks on the 22d was central nw. of the Azores, with pressure below 29.50 (749) and strong gales; by the 24th this storm had moved ne. of the Azores; on the 25th it was apparently central about midway between the Azores and the Bay of Biscay; on the 26th and 27th it was central sw. of Ireland; and on the 28th it had apparently moved s. of the British Isles over the continent of Europe. On the 24th a storm, with pressure below 29.40 (747), was central n. of Newfoundland, having advanced from the Gulf of Saint Lawrence, after which it disappeared n. of the region of observation. On the 25th a storm, with pressure below 29.30 (744), was central s. of Newfoundland, whence it moved ne. and disappeared n. of the region of observation after the 27th. On the 25th a storm of moderate strength was central off the e. Florida coast, whence it moved northeastward, and at the close of the month was central e. of Nova Scotia. From the 26th to the 30th the pressure continued low over mid-ocean. On the 29th the pressure fell to 29.40 (747) in the Hebrides Islands, and it continued low over the British Isles during the 30th.

## OCEAN ICE IN APRIL.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for April during the last 9 years:

| Southern limit. | | | Eastern limit. | | |
|---|---|---|---|---|---|
| Month. | Lat. N. | Long. W. | Month. | Lat. N. | Long. W. |
| | ° ′ | ° ′ | | ° ′ | ° ′ |
| April, 1883 | 40 49 | 52 06 | April, 1883 | 48 00 | 43 00 |
| April, 1884 | 41 26 | 48 46 | April, 1884 | 45 25 | 43 34 |
| April, 1885 | 41 40 | 49 50 | April, 1885 | 44 10 | 39 41 |
| April, 1886 | 40 51 | 46 39 | April, 1886 | *47 43 | 30 11 |
| April, 1887 | 40 02 | 50 04 | April, 1887 | 48 00 | 38 18 |
| April, 1888 | 41 33 | 50 00 | April, 1888 | 47 40 | 49 00 |
| April, 1889 | 43 57 | 50 20 | April, 1889 | 47 16 | 43 11 |
| April, 1890 | 40 00 | 49 40 | April, 1890 | 47 26 | 35 42 |
| April, 1891 | 40 01 | 48 24 | April, 1891 | 45 33 | 43 32 |
| Mean | 41 13 | 49 32 | Mean | 46 48 | 40 41 |

*Isolated iceberg.

Ice was reported about 1° south and about 3° west of the average southern and eastern limits of Arctic ice for April. The southernmost ice reported was a square, flat berg, observed on the 13th, and the easternmost ice reported was an iceberg noted on the 20th, in the positions given in the table. Ice was most frequently encountered along the se. edge of the Banks of Newfoundland, but was reported westward to the Newfoundland coast. Large quantities of field ice in the Gulf of Saint Lawrence and on the Cape Breton, east Nova Scotia, and west Newfoundland coasts seriously interfered with navigation. Compared with the corresponding month of preceding years the Arctic ice reported for the current month about corresponded in quantity and distribution with the April average. The positions of Arctic ice reported for April, 1891, are shown on Chart I by ruled shading.

## FOG IN APRIL.

The limits of fog-belts west of the 40th meridian, as reported by shipmasters, are shown on Chart I by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on 10 dates; between the 55th and 65th meridians on 6 dates; and west of the 65th meridian on 3 dates. Compared with the corresponding month of the last 3 years the dates of occurrence of fog near the Grand Banks was 7 less than the average; between the 55th and 65th meridians 6 less than the average; and west of the 65th meridian 9 less than the average. Fog was generally reported in the east quadrants of general storms which advanced eastward from the American continent. On the 4th, 11th, 12th, 14th to 19th, and 21st dense fog was reported at points along the New England, New York, and New Jersey coasts, its occurrence, as a rule, attending the approach of general storms whose influence extended off the coast.

## TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

Many of the voluntary stations do not have standard thermometers or shelters.

The distribution of mean temperature over the United States and Canada for April, 1891, is exhibited on Chart II by dotted isotherms. In the table of Signal Service data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. The monthly mean temperature for regular stations of the Signal Service represents the mean of the maximum and minimum temperatures.

The mean temperature was highest in extreme southeast California, southwest Arizona, and south Florida, where it was above 70°, and the mean temperature was above 60° in the east and west Gulf states, in the Mississippi Valley northward to the lower Ohio valley, over the southwest part of the southern plateau, and from south California over the San Joaquin and Sacramento valleys. The mean temperature was lowest in the lower Saint Lawrence valley, in extreme north Ontario, and at mountain stations in central Colorado, where it was below 35°, and the mean temperature was below 40° in northeast New England, the north part of the upper lake region, from south-central Wyoming to north-central New Mexico, in the northeast part of lower Idaho, and at stations on the Central Pacific Railway crossing the summit of the Sierra Nevada Mountains in California.

The mean temperature was above the normal north of a line traced from the south Atlantic coast northwestward to the extreme north Pacific coast; to the southward of this line the month was cooler than the average April. The greatest departure above the normal temperature occurred from the Red River of the North Valley north and northwest over the Brit-